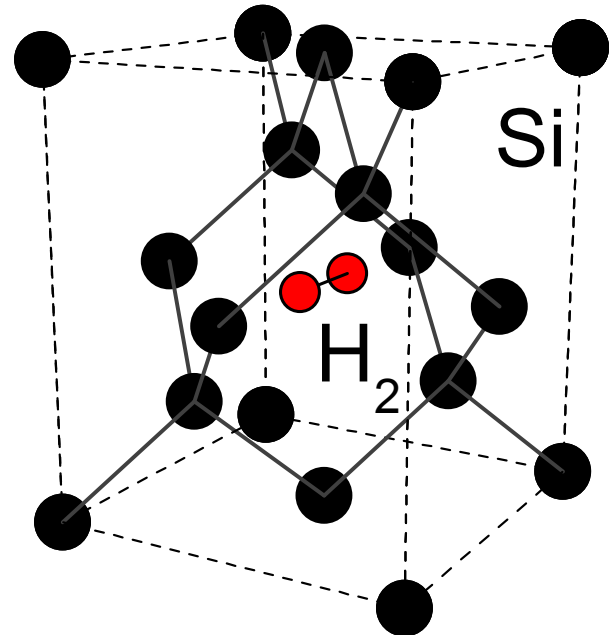


# Structures and Properties of Hydrogen-containing Defects in Semiconductors

Michael Stavola, Lehigh University, DMR-0108914

Hydrogen in semiconductors has been of interest for many years because of the important effect H can have on the electrical properties of device materials. For example, H is a frequent unintentional contaminant that affects the controlled doping and reliability of semiconductors. Alternatively, H can have beneficial effects in low-cost materials that are highly defective. For example, H is introduced intentionally into solar-grade Si to increase the efficiency of solar cells. The mechanisms by which hydrogen interacts with defects in semiconductors remains poorly understood.

Our recent studies have focused on the properties of the interstitial  $H_2$  molecule in Si (right).  $H_2$  is an important source of H that can participate in defect reactions.  $H_2$  in Si has given rise to a number of perplexing puzzles since the discovery of its vibrational spectrum. Experimental and theoretical work performed by our group establishes that interstitial  $H_2$  in Si is a nearly free rotator, providing a simple explanation of its microscopic properties.



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This research program provides an excellent means to train graduate and undergraduate students in experimental semiconductor physics. Our work focuses on important, current problems in semiconductor materials research and provides an excellent opportunity for students to learn about the physics of semiconductors, crystal defects, and materials characterization. Strong efforts are made to attract students from underrepresented groups into careers in science. Of the six graduate students supported by this grant in recent years, five are women. Lehigh's REU program attracts top undergraduate students nationwide to participate in our research program.

Marcie Weinstein (right) received a \$7000 award from the Philanthropic Education Organization in recognition of her research work at Lehigh. Weinstein became a Senior Member of Technical Staff at Draper Laboratory following the completion of her Ph.D. dissertation.

